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JOURNAL OF
OIL & FAT INDUSTRIES
The Official Organ of The American Oil Chemists' Society

Vol. III DECEMBER, 1926 No. 12

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Editorial

ANOTHER MILESTONE REACHED

This issue of the JOURNAL appears in a garb different from any of its predecessors. The type page has been divided into two columns, instead of one as formerly. The type itself is new—smaller, to better utilize the available space; but at the same time heavier and consequently much easier to read. The reader delves through the JOURNAL to find a more friendly atmosphere, the pages beckoning him to read.

The change is more than superficial; a difference in the character of the reading matter is evident. Several of the original papers forsake the laboratory completely. The leading article describing a model cottonseed crushing plant has an almost universal appeal, and although more suggestive than complete in the scope of its treatment, is a discussion of the first importance. Mr. Thurman's review, "What We Do With Our Vegetable Oils," draws an excellent picture of the many ramifications of this industry. William Scheck, dropped in the office the other day from the Holy Land, and recounted to us how other nations are girding their loins with the most modern and efficient weapons of industry to compete with our own oil producers. This thought underlies the article he has written. Mr. Bosart's paper on the metric system is likewise quite universal in its appeal.

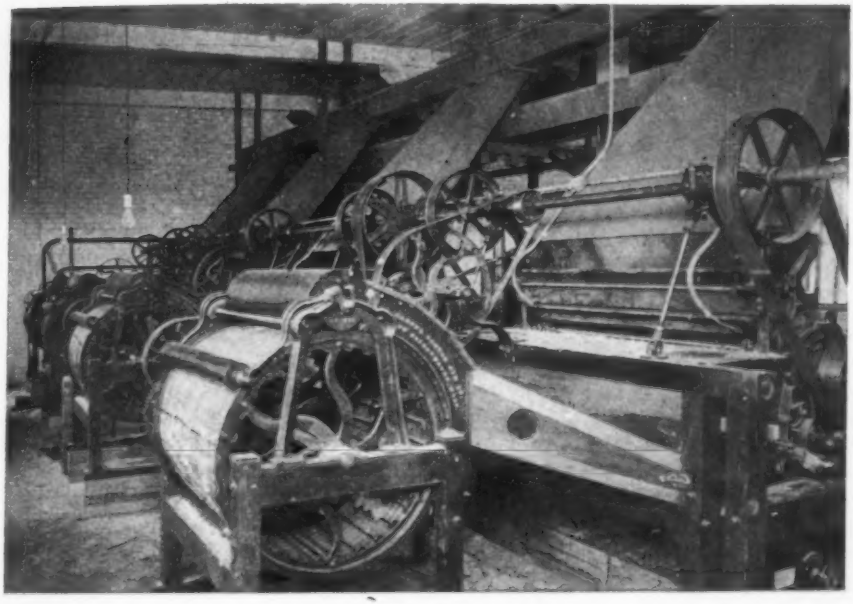
In this transformation, the JOURNAL is fulfilling its natural destiny. The founders of the publication produced the first number along strictly scientific lines nearly four years ago; but even at that very early date the hope was expressed that it one day would serve a wider sphere of usefulness. For two years almost insuperable obstacles prevented its appearance with greater frequence than as a quarterly. Then occurred the second important period in the publication's life history: since the beginning of the current year, an issue has been published every month.

Although the events we have just chronicled have covered a period of only three brief years, they offer a striking and significant parallel to the great industry the publication serves. Like so many other industries, the origin of the production and the utilization of vegetable and animal oils was in the laboratory. These products were not and could not be utilized by industry until the chemist solved the basic problems involved. Indeed, in this respect the work of the chemist has just begun; for who can venture to predict the almost limitless uses to which these products will be put in years to come.

Therefore, it is fitting that the JOURNAL OF OIL & FAT INDUSTRIES should indeed be a journal of industry, as well as of the laboratory. Its policy will be to continue to publish purely scientific papers as before, and to improve this department of the paper in both quantity and quality. To this, however, will be added articles of wider application and interest.—J. T. O.

A Model Plant Demonstrates Efficient Methods for Cottonseed Crushing

The layout and equipment of this factory represents the last word in scientific cottonseed crushing and is worth careful study.



Part of a battery of linters at the demonstration plant of the Western Engineering Co. plant. These machines are all electrically driven

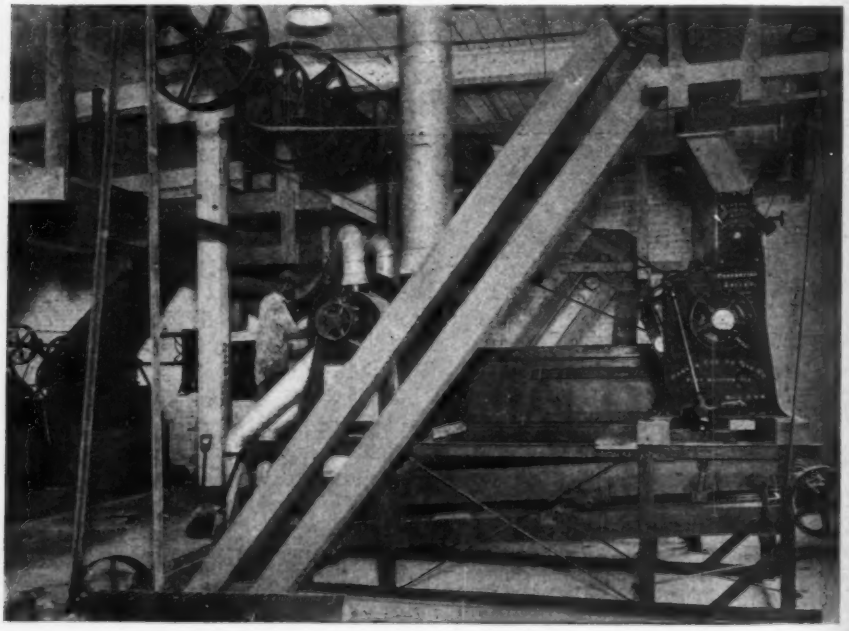
THE Western Engineering Company of Dallas, Texas, builders of vegetable oil crushing plants, have just completed and put into operation a model demonstrating plant at Garland, Texas, for the crushing of cotton seed.

The seed house is of truss type construction, 60 feet wide at the base and 8 feet at the top, 35 feet from the ground, being constructed entirely without supporting posts and having the natural slope of a pile of cottonseed so that, when seed is discharged from the overhead conveyor, this seed storage house completely fills itself. The seed is cleaned in the seed house, then elevated and conveyed overhead to the two-story brick and concrete mill building where it passes through automatic scales and falls into a supply bin which holds enough seed to furnish ample supply to run the plant for 18 hours. By the use of this bin, the seed house is operated only during the day and enough seed is accumulated in the supply bin during the day to furnish ample supply for continuous operation of

the mill during the night. The seed from this supply bin is fed to the mill by a special constructed feeder which is so regulated to discharge from this bin only enough seed to supply the line of linter machines. Any overflow or surplus of seed from the linter machines is returned and discharged back into the bin, but this seed does not pass through the automatic scales. After the cotton seed passes through the linter machines, it is then conveyed to a Bauer Bros. 153 Special separating unit which separates the meats from the hulls, the hulls passing to the hull storage house and the meats passing through the protein control machine, then going directly to the press room.

The press room of this mill is equipped with three Anderson oil expeller type presses, two of these being of the new model roller bearing type and built along modern ideas of heavy machinery construction. These roller bearing presses have been under construction and testing for the past eight years, and the two at Garland are the first of the new model type to be shown to the industry. They are very rigid in construction, exert greater pressure than the old type Anderson expeller and produce greater capacity and lower extraction than heretofore known.

The cotton seed meats coming from the separating machinery flow directly into a special dryer which gives control of the amount of moisture to be left in the seed, and the meats then go directly to the presses which are continuous in operation. The presses receive a steady stream of meats. As the meats pass through the presses, the oil is pressed out and picked up at the bottom of presses with an oil pump and pumped into a scale tank



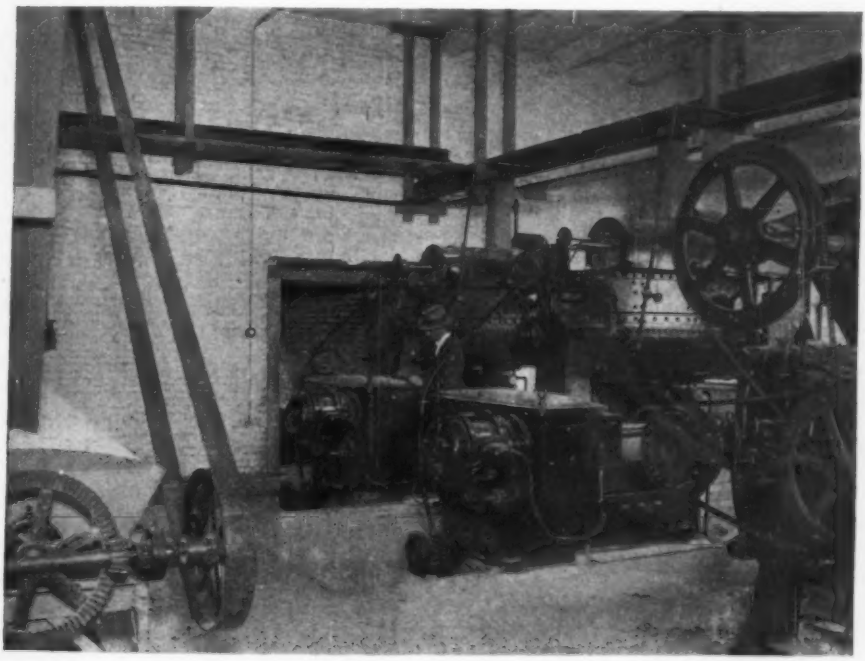
Separating equipment, elevators and conveyors

and, after being weighed, it is pumped into a storage tank. The cake comes from these presses in a continuous stream and drops into a conveyor which carries it to the meal grinding room where it is ground and sacked.

The necessary steam used for drying (it is not necessary to cook with cookers as in the old style mills) is furnished by a 20 horsepower marine type boiler fired with natural gas. The equipment for the boiler room also includes all automatic control features on both gas burner and boiler feed pump, thus eliminating the use of a fireman.

This plant has also a complete and up-to-date chemical laboratory with a competent chemist in charge where all products and materials are carefully analyzed.

The entire plant is equipped with General Electric motors, the power being furnished by a high tension power line of the Texas Power & Light Company. The motors are of the latest design, starting with a 30-horsepower motor in the seed house which operates all of the seed house equipment, seed cleaning machines and delivers the seed to the mill building. A 50-horsepower motor drives the line of linter machines and a 40-horsepower motor drives the separating equipment, elevators and conveyors. Both of these motors are equipped with silent chain drives. In the press room are two small motors to operate elevating and conveying equipment. The roller bearing Anderson expeller presses are equipped with special built-in General Electric motors requiring no clutch, this being standard equipment on these new type presses. These



Anderson Cold Press Expellers

Seed house equipment and cleaners are likewise driven by individual motors

presses are started and stopped by a push button mounted on each machine. The smallest motor in this plant is a one-sixth horsepower motor in the laboratory operating the line of agitators.

One of the novel features of this plant is the direct reading meters mounted on each motor which show at a glance the amount of horsepower required by each machine. There are also graphic wattmeters showing the variation of the load.

As all cotton seed is weighed into this plant and all lint, meal or cake and oil is weighed out, it is possible at all times to have an exact check on just what is being done and to know from the recording instruments what power is required to do the work. The plant has a capacity of 25 tons daily and requires 6 men during the day and 3 men at night to operate.

Southern cotton interests are agitating the substitution of cotton in place of jute bags for shipping cottonseed meal. One individual states that it would require about 4,000,000 bales of cotton for this purpose alone. The Coweta Cotton Oil Co. states that it is now using cotton bags, which it finds slightly more expensive. M. L. Taylor, secretary-treasurer of that company, has issued an appeal to all oil mills in the south to come to the rescue of the cotton crop by using cotton bags. "If everyone used them," he says in the *Atlanta Constitution*, "it would put all on a parity."

What We Do With Our Vegetable Oils

By B. H. THURMAN

American Linseed Company

A RECENT issue of *The Nation's Business* names two out of five outstanding achievements in modern chemistry—the development of vegetable oils and the manufacture of artificial leather. As striking examples, it was stated that there are not sufficient cattle to supply natural leather for automobile manufacture alone and that vegetable shortening replaces the fat or lard of many million hogs per year. It is interesting to see the vegetable oil industry given the recognition it deserves. The history of its growth and development, however, is not described by such brief analogy.

Little has been written of the early methods of producing vegetable oils. The history of producing cottonseed oil, by Wesson, in the proceedings of the Institute of Chemical Engineers, Vol. XII, part 2, is the best and most interesting account of the beginning of that branch of the vegetable oil industry in the United States.

Linseed oil production was an earlier development beginning before the 60's. Cottonseed and other vegetable edible oils have been developed in the United States in the last thirty-five years. In fact, it is safe to say that every investor and those employed in the vegetable oil business today can thank the grand old man of the industry, David Wesson; because, until he started the deodorization of vegetable oils in 1892, there was little development and probably would not have been more than this little were it not for his invention.

Vegetable oils can be briefly classified as follows:

1. Solid fats or oils.
2. Non-drying oils.
3. Semi-drying oils.
4. Drying oils.

Cocoanut, peanut, cotton and linseed oils are examples of each class and are those most extensively used in the United States. They are used principally for edible purposes with the exception of linseed oil which is used industrially in the arts.

Cocoanut oil consumption by the soap makers is enormous and they produce from it a soap giving a quick luxurious lather and one that cleanses in spite of hard, and even sea waters. The latter quality is peculiar to the cocoanut oil class only. This oil is also adapted for any use where oxidation would cause odors, as in textile soaps and lubricants. The iodin number of 8 to 11 being extremely low, the oil is subject only to very slow oxidation or rancidity.

The consumption as edible oil goes into many of the high quality food products. As a shortening for biscuits requiring long keeping quality its slow reaction to oxygen makes it without equal for this purpose. The amount and kind of fat used in a biscuit is the measure of its keeping quality. For example, it is well known that hard tack contains no fat or shortening agent and therefore keeps indefinitely.

By chilling and pressing cocoanut oil in bags the stearine is made. This, however, is not a true stear-

ine, but a solid portion of the oil melting around 84 to 88° F. The liquid or soft portion is called "olein" and melts around 72 to 74° F. The stearine is the more valuable product having a high latent heat of fusion and when mixed with sugar and placed between wafers makes the well-known Nabisco which has the pleasing, cooling taste when eaten. This is due to the quick absorption of heat by the stearine changing from a solid to a liquid within the narrow range of 2 to 4° F. Other uses for this product of cocoanut oil is for shortenings and coatings. The soft portion or olein is an excellent frying fat for peanuts, potato chips and even clams. It is also used as shortening in baked products. The production of stearine in the United States is perhaps ten million pounds per year.

Probably the most important use for cocoanut oil is in margarine where 82 million pounds per year are used in the purely vegetable product. Langworthy & Holmes of the U. S. Bureau of Home Economics have shown by human digestive experiments that cocoanut oil is slightly more digestible than butter fat. The flavor and light color of this oil is not equaled by any other consumed here. The importations as oil and the production from copra for the year 1925 were, respectively, 233,174,000 pounds and 229,367,000 pounds, and of the total 462,541,000 pounds only 17,900,000 pounds were exported, the balance being consumed in the U. S. In addition to the amount consumed by the purely vegetable margarine manufacturers considerable is used in what is called animal fat margarine.

Palm kernel oil with an iodin number of 15 to 17 is very similar to cocoanut oil in physical constants and use. However, only 52,624,000 pounds were imported in 1925 and none was produced here. Though there is a striking similarity between palm kernel and cocoanut oil experience has taught the consumer that cocoanut oil is the sweeter and better keeping product of the two.

Peanut oil is an example of the non-drying class having an iodin number of 90 to 94 and is used for shortening, frying, and as a table or salad oil, like olive oil. Though the iodin number is rather low, yet peanut oil remains limpid in the home icebox or refrigerator and therefore is practically a salad oil as is. It has the wonderful power of producing a thicker emulsion when made into mayonnaise dressing than other similar oils. The work of Langworthy & Holmes shows it to be slightly more digestible than most oils. However, that might not be the reason that considerable quantities are consumed in the manufacture of chewing tobacco. The importation of peanut oil in the year 1925 was only 3,026,000 pounds while the domestic production the same year was 15,156,000 pounds. Before the increased tariff on this product there was imported and produced in 1918 about 96,000,000 pounds. The production being small the use of this oil is limited and it might be safe to say that the main consumption for this product is in margarine where it adds plasticity or buttery texture.

Cottonseed oil with an iodin number of 108 is hardly representative of the semi-drying oils but it can be called the leader of all vegetable oils. The production of refined oil in 1925-26 crop year was 1,363,098,000 pounds, of which 21,000,000 pounds were exported, the remainder being consumed in the United States. The greatest consumption of this oil is in the form of vege-

table shortening which has been greater than the consumption of hog lard in this country, being 1,152,620,000 pounds in 1925. The quality of the product is accepted by consumers to be equal to and better than hog lard, and at times it sells for a considerably higher price. Dr. Clarke E. Davis, however, has shown by his "shortometer" that the animal product is somewhat more efficient as a shortening agent. About 15 or 20 per cent of the refined cottonseed oil production, or 270,000,000 pounds, is converted into winter cottonseed oil. This product is the universal salad or table oil. Its use extends from the packing of fine sardines to the most delicate and delicious salads. A large portion of this product goes for home and commercial mayonnaise and salad dressings. Mayonnaise contains from 77 to 87 per cent of oil and about 50 to 60 million pounds are used in the manufacture of commercial dressings yearly.

For deep frying, such as doughnuts and potatoes, large quantities of both cottonseed oil and vegetable lard are used. Some of the cottonseed stearine made by the winterizing process and the hydrogenated oil are used in margarine.

Corn oil is certainly representative of the semi-drying oils having an iodin number of 117. Practically the whole production of 104,000,000 pounds in 1925 went to the trade for use as a salad and cooking oil. There seems to be a belief among some experimenters on shortening agents that the higher the iodin number the better the shortening. However, in making mayonnaise, it is easy to demonstrate that corn oil does not produce as thick or stable an emulsion as cotton oil does. Yet, large quantities are evidently used by the housewife today for this purpose.

Soya bean oil is almost a drying oil—but not fast drying like linseed—and can be classed as semi-drying, with an iodin number of 126 to 134. Practically none of it is used for edible purposes now, although during the war large quantities were used in this way. Imports of 19,492,000 pounds in 1925 went almost entirely to the paint, varnish and lacquer trade for some special use; such as, for artificial leather coatings and for adding flexibility to gums and enamels.

China wood oil is one of the drying oils, although in the raw state it dries slower than linseed. When cooked in the varnish kettle it will dry as quickly and will harden much faster than linseed in the paint and varnish film, the treatment and other conditions being similar. Imports of 101,000,000 pounds in 1925 show that it is of considerable importance. Because of its wonderful property of waterproofing rosin in the varnish film it is used almost entirely by the varnish makers. It is not used in its raw state as linseed and soya are except where a peculiar, yet beautiful crystallizing effect is desired in the paint or varnish. It is also peculiar in that it has not been successfully refined by caustic, acids or Fuller's Earth.

Linseed oil is the premier and universal paint and varnish oil having been used for centuries and as such it still holds first place. Over 763,000,000 pounds were produced in the United States in 1925. Although nitrocellulose lacquers may replace considerable varnish, it is unlikely that linseed oil consumption has been curtailed while perhaps the use of China Wood oil has. In fact, recent experiments have been performed showing that linseed oil adds to the stability of lacquers better than gums and the

other oils originally used. For patent leather varnishes and lacquers linseed oil seems to be unexcelled. Four distinct types of linseed oils are used by the manufacturers of paints, varnishes and artificial leather coatings—raw oil, blown oil, caustic refined and acid refined—each having its distinct and preferred use. However, one of the most recent developments by R. H. Adams after years of experimenting in the refining of linseed oil has entirely changed the old methods. By his new process a linseed oil is produced without the aid of refining agents, having a color lighter than any linseed oil refined with caustic or acids. As one oil it replaces in use the raw, caustic and acid-treated oils, and gives a quality never thought possible.

It is interesting to note that such oils as rape and sesame, while used to a great extent for edible purposes in Europe, have not found favor in America. Undoubtedly rape and sesame oils are fine edible oils equal in digestibility to peanut oil and their low iodin numbers and other qualities make them strong competitors of this product elsewhere. Practically the entire importation of rape oil is blown or oxidized for use in artificial leather coatings, except that which is refined with acid and used by petroleum refiners to raise the flash point of their illuminating oils.

Olive oil is unique because it is possibly the only vegetable oil consumed here in its natural raw state without any refining or processing. Though it has been the leader as a salad oil for centuries, the majority now prefer the neutral flavor of refined cotton and peanut oils for both cooking and salad purposes.

The use of vegetable oils industrially has just begun, from a scientific viewpoint, as many concerns are spending very large sums yearly for research in this vast field.

BULLETIN ON TUNG OIL

According to a bulletin recently published by the University of Florida, experimentation with Tung Oil trees is progressing actively at that place. On one six-acre planting, 14 different fertilizers and combinations of fertilizers have been tried, and a number of buds from selected trees added to this planting. During the year, 75 pounds of seed and over 1,900 trees were distributed for testing purposes to 70 growers in the state.

Vegetable Oils Victorious in Pure Food Ruling

Canned sardines packed in any pure, wholesome, edible vegetable oil may be labelled under the Federal food and drugs act as "Packed in Vegetable Salad Oil" or "Packed in Salad Oil" without specifying the exact oil employed, according to a ruling issued by the Bureau of Chemistry, United States Department of Agriculture.

In 1907 after the public had become used to buying sardines packed in olive or peanut oils, other oils came into use, prominent among which was cottonseed oil. Regulations were passed at that time which made necessary the naming of the oil on the label. Later, in 1923, the term, "Salad Oil" came into use, and it is believed by the chemistry department that a continuation of this term will not create deception.

Refining Method for Crude Cottonseed Oil

By C. B. CLUFF, *Chairman*
Refining Test Committee

THE work on this subject which was published in the November issue of this journal has been continued with results as shown below:

Time of Settling at Room Temperature before Decanting Oil

	Low Oil		High Oil	
Time	Color Red	Loss Per Cent	Color Red	Loss Per Cent
3 hours	10.2	14.3	21.0	53.0
16 hours	9.8	14.1	23.0	52.0

Apparently only slight change in color or loss occurs after three hours.

Additional Settling of Refined Oil at Room Temperature after Decanting

	Color Red
Filtered immediately after decanting	10.5
Filtered 12 hours after decanting	10.2

Confirms previous observations that a slight improvement in color usually occurs after prolonged settling.

Time of Reheating Foots from High F. F. A. Oil in Hot Bath at 65°C

	Oil Recovered	
Time Heating	1st Heating Per Cent	2nd Heating Per Cent
20 minutes	2.5	.4
60 minutes	2.9	.7
Increased Recovery	.4	.3

Apparently 20 minutes heating of large masses of foots is not quite sufficient.

Stirring Foots During Remelting

	Oil Recovered (High F.F.A. Oil)
Not stirred	2.5%
Stirred	None

Shows necessity for remelting *without stirring.*

Effect of Rusty Refining Cups

Refinings were made in extremely rusty cups and in clean cups for comparison. Low F. F. A. Oil was used.

Cups	Color Red	Loss Per Cent
Clean	10.3	14.4
Rusty	10.3	14.9

Rust has no effect on color but loss apparently increases slightly with the abnormal amount of rust on these cups, which was far greater than would ever be present in ordinary usage. Any ordinary amount of rust would evidently have no measurable effect. We conclude from this that the use of enameled cups to avoid rust is not essential.

Comparative Rates of Heating in Enameled vs. Plain Iron Cups of Identical Dimensions in Bath at 64° C.

	Time and Temperatures				
	0	2	4	6	8 Mins.
Plain Iron	21°	42°	53°	58°	60°C.
Enameled	22°	41°	51°	57°	59½°C.

Rate of heating, and final temperature attained in eight minutes are practically identical, showing that enamel does not noticeably retard the transfer of heat under these conditions.

Impurities in Lye (NaOH content unchanged)

(A) Carbonate of Sodium

No2CO3 as % of NaOH used Per Cent	Low Oil Color Red	Low Oil Loss Per Cent	High Oil Color Red	High Oil Loss Per Cent
0	9.8	14.7	275	51.4
5	10.0	14.8	265	50.6
10	10.2	14.8	265	49.8
20	10.2	14.6	270	49.5
30	10.3	14.7	285	48.5
40	10.5	14.7	285	48.7

(*B*) *Iron added as Ferric Hydroxide, freshly precipitated.*

Fe as % of NaOH Used	Color Red	Loss Per Cent
0 per cent.....	10.2	14.7
2 per cent.....	10.5	14.1
4 per cent.....	11.6	14.3
8 per cent.....	11.7	14.1

(*C*) *Aluminum Added as Hydroxide, freshly precipitated.*

Al as % of NaOH used	Color Red	Loss Per Cent
0 per cent.....	10.0	14.8
2 per cent.....	10.1	16.8
4 per cent.....	10.5	15.8
8 per cent.....	10.7	15.2

Note: Aluminum added in this form neutralizes a portion of the NaOH.

(*D*) *Aluminum added as Sodium Aluminate, powder.*

Al as % of NaOH used	Color Red	Loss Per Cent
0 per cent.....	10.2	14.4
2 per cent.....	9.7	18.3
4 per cent.....	9.4	20.2

Note: Aluminum added in this form does not neutralize any of the NaOH used for refining.

(*E*) *Calcium added as Hydroxide, freshly precipitated.*

Ca as % of NaOH used	Color Red	Loss Per Cent
0 per cent.....	10.2	14.7
2 per cent.....	10.1	14.7
4 per cent.....	9.9	14.5
8 per cent.....	9.9	14.8

(*F*) *Silicate of Sodium added as solution at 40° Beaumé. Note that percentage here is per cent Silicate solution on crude oil used.*

Silicate Sol. as % of Oil used Per Cent	Low Oil Color Red	Low Oil Loss Per Cent	High Oil Color Red	High Oil Loss Per Cent
0	10.2	14.4	260	51.2
2	15.5	10.5	270	48.7
4	19.1	10.2	380	48.0

The various impurities studies as described above were those which may occur in caustic soda solutions, due either to the chemicals used in making sodium hydroxide, or to impurities dissolved when the solution stands in glass bottles.

It appears that all these impurities have a bad effect on either color or loss except Calcium Hydroxide which has very little effect on either. The most serious impurities are Aluminum and Silica in the forms of Sodium Aluminate and Sodium Silicate respectively; the latter especially is apt to be present in solutions which have stood in glass bottles for a long time.

The necessity of using only the purest possible solutions of Sodium Hydroxide should be clearly evident to every chemist from these results, both from the standpoint of obtaining the best possible color and loss, and to avoid discrepancies among different operators.

Summary (continued from November issue, page 381).

12. Sodium Hydroxide solutions must be free from all impurities.
13. Time of settling at room temperature, 3 hours.
14. Time required to remelt Foots in water bath at 60-65°C, 30 minutes.
15. Foots must not be stirred while remelting.
16. Enameled refining cups have no advantage over plain iron, but are not in any way objectionable.

Conclusion

Acknowledgment is again given to Mr. Nelson W. Humbaugh who carried out the analytical work here recorded.

A proposed revision of the refining method as at present written which is intended to embody all the points found desirable, is now in the hands of the members of the Refining Committee for consideration and test.

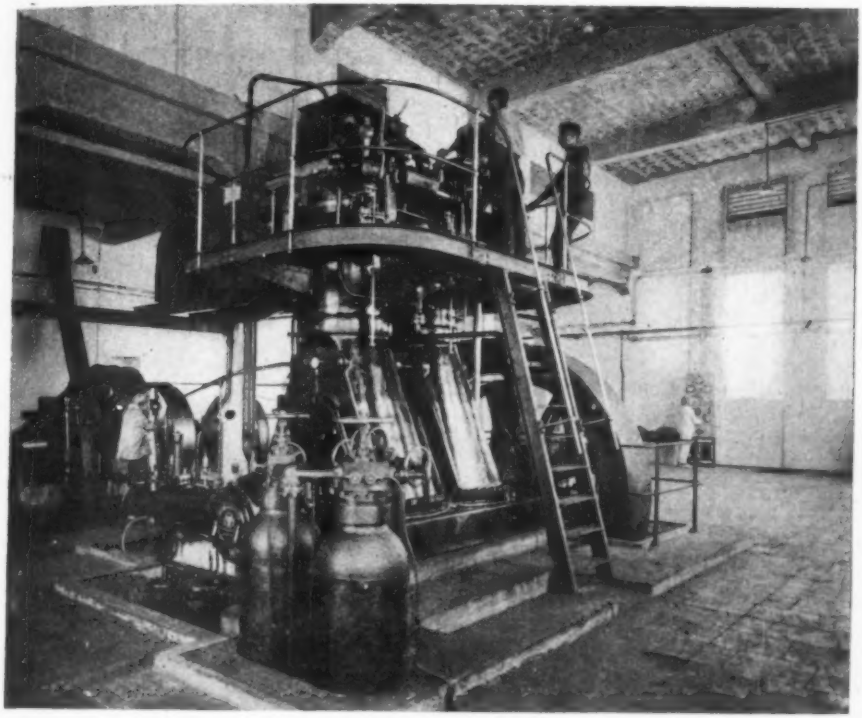
WRITES ABOUT TUNG OIL

J. Francis Cooper, of the Florida Experiment Station, Gainesville, Fla., has written an interesting article in the November issue of *Better Crops*, which he has entitled "Tung Oil."

Ancient Palestine Has an Up-to-the-Minute Soap and Oil Plant

By WILLIAM SCHACK

One and a Quarter Million Dollars Are Invested in a Plant That Produces Linseed, Sesame, Cocoanut, Sun Flower, Olive and Other Oils Besides Laundry and Toilet Soaps.



Diesel engines insure a continuous power supply

ONE of the outstanding sights of the ancient city of Haifa, in the north of Palestine, is the plant of Palestine Oil Industry Shemen, Ltd. This splendid, modern structure is most picturesquely located, situated as it is in a grove of date palms on a strand that curves between Haifa and Acre, where the Bay of Haifa is hollowed out of the Mediterranean Sea. Behind it rises Mt. Carmel, rapidly being developed as a summer resort not only for West-Asiatics, but for Europeans as well.

The site of the Shemen plant is not merely pretty and healthful, however; it has its great commercial advantages. In the first place, it fronts on the Nablus Road. This great artery of commerce runs east from Haifa, cuts straight through the heart of the most recently developed agricultural settle-

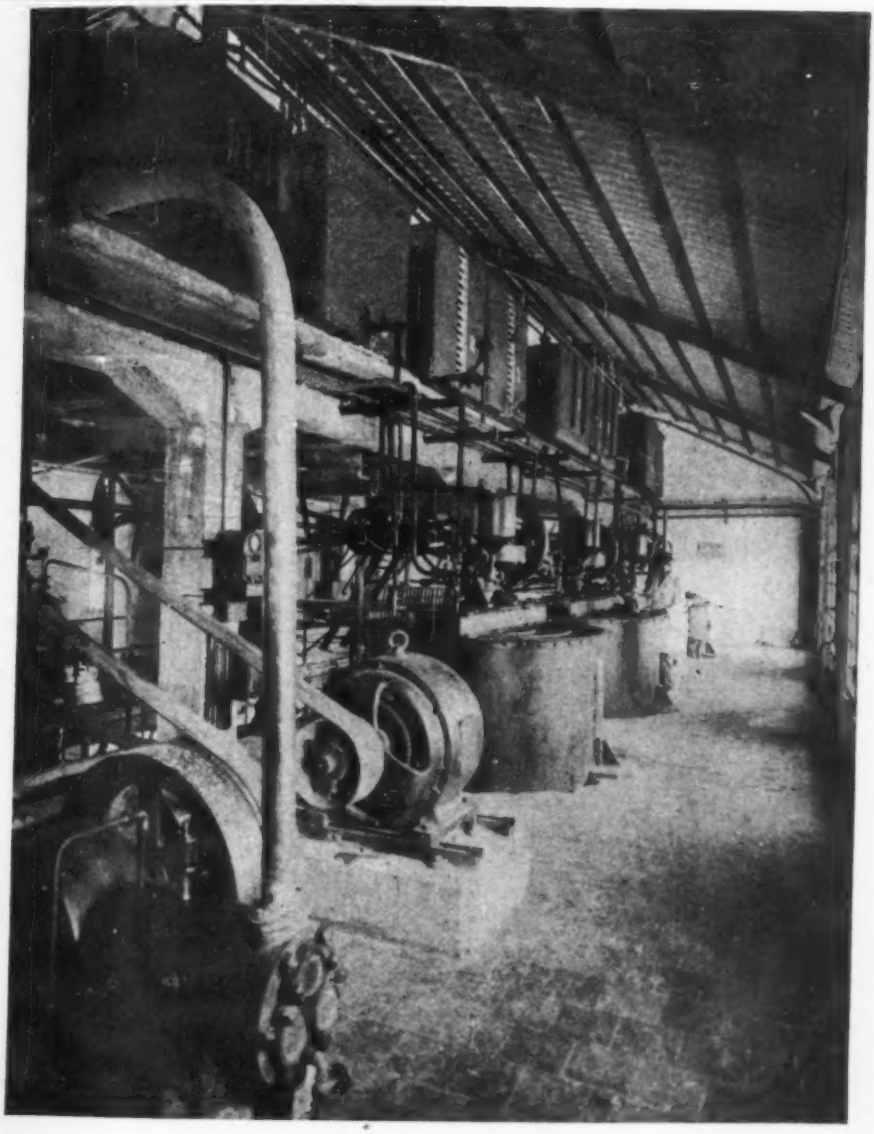
A view of the main factory building, with pressing plant, boiler room and refinery appearing in the background

ments in the Valley of Esdraelon, and finally runs down into the well-populated central portion of the valley into the city of Jerusalem.

Another great advantage to the factory is its location on the Bay of Haifa, which unquestionably is destined to be the scene of great harbor improvements in the immediate future. At the present time Palestine has no good port. The one at Jaffa is rocky and narrow on the sea side and too cramped on the land side. It takes care of most of the sea transport of the country now, as it has done for a long time, although articles weighing more than three tons are entered at Haifa. Haifa has certain advantages which make it probable that the extensive sums of money which will be needed for making a harbor will be used there. One of the major reasons is that this part of the country has seen the largest industrial development.

Grounds surrounding Palestine Oil Industry Shemen, Ltd.

Before touching on the Shemen plant itself, it might be well to explain how such modern factories have happened in so honorable and ancient, but quite desolate a land. The whole impetus to the industrial development of Palestine is of very recent origin. Before the war the country was visited by tourists, mostly for its religious associations; no one thought of Palestine as modern in our western sense.

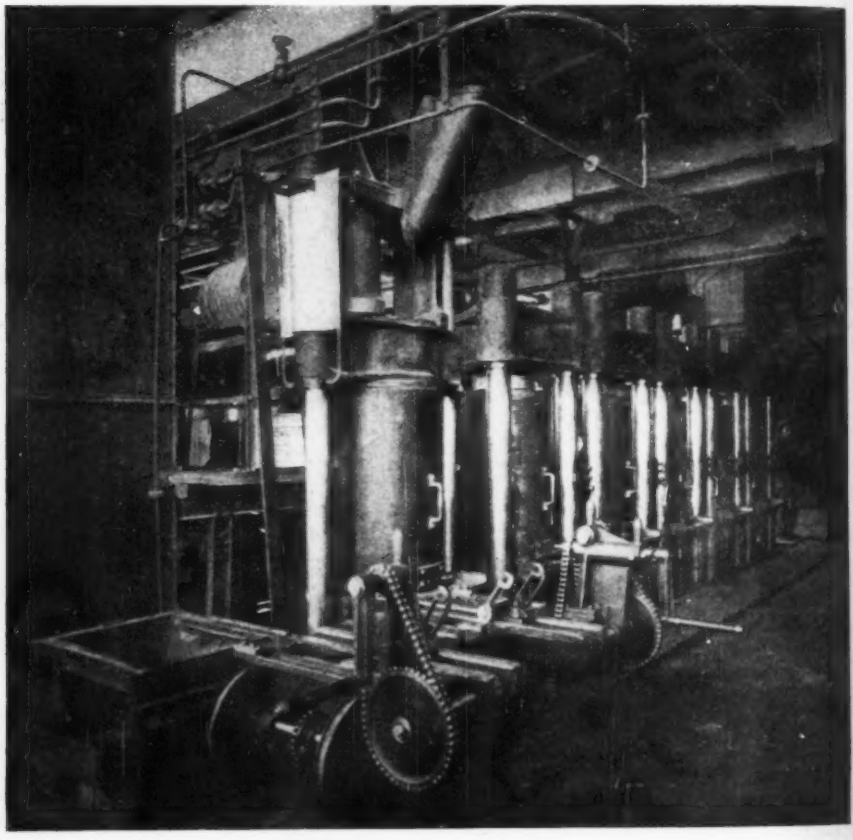


A view of the refinery

The natives—the overwhelming majority of them, at least—lived in the primitive fashion of their remote ancestors, and the Turkish government did nothing to improve the standard of living. There were virtually no decent roads, no effectual railroad service, no stimulus to rising above the crude agricultural methods practiced (and still practiced, by the natives), no industry.

The country took on new life when it became a mandate of England and the latter issued the Balfour Declaration pledging itself to foster the development there of a Jewish homeland. For a generation some Jewish colonies had been at work at orange and vine growing and wine making with notable success; but now, in addition to the infusion prior to the agricultural settlements, industry sprang up. And along with the laborers, skilled and unskilled, who in the last five years have come in from all parts of Europe, manufacturers have come to put their experience and capital to work in the new country. Factories, smaller and larger, have begun to dot the country.

The Palestine Oil Industry Shemen was organized chiefly by a group of Russian Jews, E. Pineson



A battery of oil presses

being president of the concern, and the manager, S. Glucksmann. Now, towards the end of its second year of existence, the enterprise is beginning to pay its way. It is capitalized at 250,000 Egyptian pounds, or $1,250,000, of which one-half is invested in the plant itself.

This company produces linseed oil and edible oils, especially olive oil, as well as sesame, cocoanut and sunflower oils. In soaps, besides a laundry article, it turns out toilet soaps of various grades, particular attention being paid to castile soap. The olive oil is made on the premises for this purpose, the olives being of domestic origin. According to S. Slitzan, engineer and assistant manager of Shemen, they are a very superior variety, the best in the market for olive oil purposes. It must be remembered that the cultivation of this fruit in Palestine is as yet far from intensive. Besides improvements in quality, the quantitative production is capable of enormous increase. Great areas of the Judaean hills, now bare and stony, lend themselves to terracing for olive cultivation. A half hour north of Jerusalem is a Russian colony of long standing which has done excellent work in this direction. The following are the official figures for olives and olive oil production over a four-year period. In reading them one should make note of the fact that there was a terrible spell of three bad farming years, 1922 to 1924, due to irregular rainfall.

Production in Tons

	1921	1922	1923	1924
Olives	405	3755	1116	3864
Olive oil....	594	3297	2983	4901

Part of the soap factory, where the soap is cut in bars and packed

The olives are brought directly to the plant from the villages, pressed the same day and refined. The oil is not stored at all for future sale but disposed of at once. During the interim when no olives are available, and therefore no business is to be done with them, the plant turns its attention to other products, also seasonal.

Although the chief market for the Shemen products is Palestine, Syria and Transjordania (Iraq) also absorb some of its output. England has also proved a good buyer of its soaps, and some were sold in the United States. The company's inadequate dealer credit arrangements in our country, however, have greatly hampered its activities there.

Of the raw materials, part of the sesame seed if produced locally and the remainder of this seed comes from the Sudan in Africa and from India. All of these olives are secured locally. The other raw materials are imported; copra, for example, coming from Ceylon and the South Sea Islands.

The seedcake by-product known as "kuzba" is sold for fodder.

At present, with the country in the throes of a slump due to overexpansion, the plant is employing only one shift; but at a full three-shift operation its capacity is 25 to 30 tons of oil seeds per day. In each shift 80 people can be used. The average wage for an unskilled laborer is $1.50 per day, and the scale runs up to $2.50 for more skilled operatives. All the men, by the way, have been trained in the Shemen plant for their work, and they have made very satisfactory progress, according to Mr. Slitzan. The wage scale, as in all of the Jewish worked enterprises in the country, is far above that prevalent in all of the surrounding Mediterranean country; for Jewish workers cannot exist on the extremely crude scale of living in which natives of these lands exist. These Jewish workers have brought with them the eight-hour day of the West. Fifty cents a day for a twelve-hour day represents an average native standard.

Everything in the plant press room, refinery and soap factory is modern, in accordance with the best standards of practice. Power is generated on the premises by means of Diesel engines.

The remote location has its drawbacks, naturally. Last year, for example, the company incurred a heavy loss because it could not get barrels (sent from Italy) on time.

It is interesting to note how superior quality wins out over all sorts of prejudices. It is common knowledge that the modern colonization of Palestine by Jews has met with stiff Arab resistance in certain quarters. Five years ago there were serious riots when native agitators interpreted the Balfour Declaration as a signal for a militant Jewish conquest. Though the Arabs, rich and poor alike, have in every instance gained economically from the advent of the Jews, indirectly, from the example of their modern methods, and directly from their active purchasing of land and agricultural produce, yet there are still agitators, most of them actuated by political motives, who keep up an offensive, within the law. Such an attitude, of course, has been inimical to Jewish products; but little by little the Arabs have taken to quality goods. The Shemen people have been through the same experience; but now they are selling soaps, for example, above the heads of the Arab makers, to Arabs, and in Arab strongholds.

A Note on the Keeping Quality of Crude Peanut Oil

By WALTER F. BAUGHMAN and GEORGE S. JAMIESON

Oil, Fat and Wax Laboratory, Bureau of Chemistry

THE results obtained in a few preliminary experiments conducted in the Oil, Fat and Wax Laboratory of the Bureau of Chemistry to illustrate the changes which crude peanut oil undergoes during storage are tabulated here. The oils used were expressed hot from shelled peanuts at the laboratory. A portion of the oil was filtered immediately through paper and approximately 500 grams of the filtered oil was placed in a bottle large enough to leave an air space of about 150 cc. above the oil. With the exception of Oils 1 and 2, similar samples of the unfiltered oils containing some of the foots also were collected. The bottles were corked and the samples stored in the laboratory. During the period of storage the temperature of the samples ranged from about 19° to 25° C., the temperature most of the time being 21° or 22° C. The acidity of the oils was determined as soon as possible after expression and from time to time thereafter. It is reported here as the "acid value," the number of milligrams of potassium hydrate required to neutralize the free fatty acids in one gram of oil. The "acid value" multiplied by the factor 0.502 gives the percentage of free fatty acids in terms of oleic acid.

The results here reported indicate that if all of the foots are removed from the crude peanut oil the keeping quality is very good indeed, but that allowing the crude oil to remain in contact with the foots causes the oil to deteriorate. There-

(*Continued on page* 449)

PEANUT OIL (Acid Values)

Sample 666	1924 Aug. 1	Oct. 8	Nov. 20	Jan. 7	Feb. 7	Mar. 7	Apr. 4	1925 May 12	June 16	July 7
1 Filtered	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.53	0.56	0.56
2 Filtered		0.68		0.68	0.68	0.68	0.72	0.75	0.75	0.75
3 Filtered	0.65	0.65	0.72		0.72	0.72	0.72	0.75	0.75	0.75
3 + Foots	0.71	0.90	1.12	1.17	1.25	1.35	1.50	1.59	1.70	1.81
4 Filtered								0.62	0.67	0.70
4 + Foots								0.62	0.67	0.89
5 Filtered								0.62	0.67	0.67
5 + Foots								0.62	0.78	0.86

PEANUT OIL (Acid Values)

	1926 Aug. 10	Sept. 1	Oct. 10	Nov. 14	Dec. 12	Feb. 6	Apr. 10	June 7	Acidity increase	Period of storage months
1 Filtered	0.56	0.56	0.56	0.58	0.58	0.66	0.66	0.66	0.16	22
2 Filtered	0.75	0.78	0.80	0.80	0.80	0.80	0.80	0.80	0.12	20
3 Filtered	0.75	0.78	0.80	0.82	0.82	0.89	0.94	1.06	0.41	22
3 + Foots	2.00	2.01	2.04	2.17	2.28	2.39	2.59	2.62	1.90	22
4 Filtered		0.70	0.72	0.72	0.78	0.78	0.78	0.80	0.18	13
4 + Foots	1.00	1.06	1.22	1.34	1.36	1.50	1.61	1.70	1.08	13
5 Filtered	0.67	0.67	0.69	0.69	0.69	0.72	0.78	0.78	0.16	13
5 + Foots	0.95	0.98	1.11	1.17	1.19	1.25	1.33	1.36	0.74	13

Measuring the Oil and Fat Industry by the Metric System

By L. W. BOSART
Procter & Gamble Company

AN Englishman, who differed somewhat from the proverbial Englishman whom we like to portray in that he possessed a sense of humor, being much impressed, on visiting this country, by the countless automobiles, telephones, adding machines, and the many and various other time-saving devices, asked the very pertinent question: "What do you do with all the time you save?" This question seemed a poser, but it is not unanswerable. Time is gained for other forms of work which is not purely labor or mental calisthenics; time is gained for play, for the pleasant things of life, and for the pursuit of our favorite pastimes or hobbies.

This is not a philosophical essay on the worthwhileness of living. However, we must consider that we are here to do our part to make the world a better place to live in, according to the light in which we see our task. Life at least denotes progress, and it is altogether fitting to strive to attain the end that our generation will have more knowledge than the preceding one and may learn to accomplish its tasks better and in a shorter space of time.

Our existence is not necessarily happier than that of our forebears of a few generations back because of the fact that we can get into an automobile or an express train and arrive at a point hundreds of miles away in a few hours that would have taken them weeks to reach. Yet we are willing slaves of progress and would not want to return to their time-consuming modes of travel.

The same thing is true of mental distances. We desire to progress, to take short cuts to arrive at conclusions. To do this, we need the best forms of tools. Of these tools, our language is one of the most important. Probably one of the great advantages the Germans have had is their language with which they spend very little time learning to spell, while few ever really master the spelling of English.

Tables of weights and measures are another form of useful tool. We are prone to overlook to what a great extent these are used in every human activity. In our monetary system, in common with most civilized countries, we have recognized the advantages of a simple decimal system. Our tables of weights and measures, however, are cumbersome, besides being time-consuming to learn and to apply. They are in constant use in all activities of life and give rise to all manner of calculations, consuming time that ought to be free for other important matters.

The day of hero worship of the Germans has probably passed, and yet the record remains of their great advance in all scientific and technical work, in intellectual pursuits, art, music, and military science, in fact, in nearly all human activities. It would not be possible to point to any one cause for Germany's preeminence in so

many different lines of endeavor, for there were probably many causes; but, no doubt, one of these is the fact that they do not have to waste time as children and continuing as adults on such elementary studies as spelling and learning the various antiquated tables of weights and measures—under which English-speaking people are handicapped—and making the many calculations which they involve. It is not possible to say how much time is thus consumed in the average life of the individual. Spelling we are always learning and there appears to be little hope of any relief from this task. Life is so full of interesting subjects that we should seek relief, wherever possible, from its drudgery. Just as the desire to do this has given us all the great labor-saving devices, so it has given us also the metric system of weights and measures which, although it was proposed one hundred and fifty years ago, the American people, who have been so keen to see the practicability of other labor-saving tools, have lacked the foresight to apply.

We have undergone a vast mental evolution. We have learned step by step to accomplish many tasks in a few minutes which it would take a less enlightened generation weeks to perform. Such mechanical manifestations of this as the spinning of thread and weaving of cloth, the telephone, automobile, aeroplane, and radio had first to be conceived in the mind.

The Chinaman, slowly figuring with his abacus, cannot see the value to him of any higher mathematical knowledge, merely because he has not arrived at the point where he has the vision to foresee its usefulness. The same thing is true with the English-speaking people with regard to weights and measures—or else it is inertia.

How much time we actually waste is a question difficult to answer and depends very much on the viewpoint of the individual. Time spent in the most trivial pursuits may sometimes be well spent. Time spent in acquiring any useful knowledge may be regarded as well spent. As children, we spend much time learning to read. We can readily see the value of this, because we continue to use the knowledge thus acquired throughout life. It is time well spent. Is this equally true of the time devoted to learning the antiquated tables for long, square, and cubical measures, of avoirdupois and troy weights, liquid and dry measure? For most of the inhabitants of continental Europe, it would be time sadly wasted; for the English and Americans it is time well spent because they have to apply them constantly. They involve considerable calculation, which is also time well spent because such calculations have to be made. But at what a disadvantage we are compared to those who do not have to spend any time in this manner!

Nearly a century and a half ago, our forefathers had the courage to break away from a clumsy, unwieldy monetary system and to substitute dollars and cents for the traditional pounds, shillings and pence. Tradition is strong, however, and that is as far as they were able to go, so we still have the pound weight, the bushel, the yard, the gallon, and a great lot of other weights and measures. Agitation has been carried on to a considerable extent, but after 130 years of successful use of a sensible monetary system, no change has been made in any of the weights and measures. Scientists, even English and American, have had to adopt metric weights and measures, since with the many calculations they

have to make the old systems would be too burdensome. Even at that, those scientists who are connected with industry have their troubles, since they frequently have to express themselves in unscientific language, and paradoxical as it may seem, must translate their simple terms into complicated ones in order to be understood by the layman. One of the commonest instances of this is in the measurement of temperature, although it is perhaps in this particular case that the layman has received the most education. The chemist in industrial organizations has to use both the Fahrenheit and the centigrade or Celsius scale, and nearly always, in describing work at certain temperatures, he has to state which scale is meant or else calculate from one to the other.

Just as in other industrial enterprises, we find both scales are used in the oil industry. In refining, the Fahrenheit scale is employed in the plant, and in the laboratory the centrigrade scale is used.

Even Germany, in doing away with antiquated systems, failed to eliminate all of them. While adopting the metric systems of weights and measures, the Germans still use the Réaumur scale for measuring temperatures, except, of course, for scientific purposes, so they have the confusion of two scales. It seems odd, in doing this, that they do not use the scale of their compatriot, Fahrenheit; but this scale, invented by a German, is used by all English-speaking people. Instead, the Germans use the Réaumur scale. Although Réaumur was a Frenchman, his method of measuring temperature is not used in France; but the French very sanely use only one scale for measuring temperature, namely, the Centigrade scale, which was conceived by a Swede named Celsius. So we have the English using a German scale which is scorned by the Germans and the Germans using a French scale which the French repudiate in favor of one introduced by a Swede.

Fahrenheit took as his zero point the coldest temprature he could get with a mixture of ice and salt. The temperature of the body was the other point taken, and the interval was divided into 12 degrees. Later, in order to indicate the temperature more accurately, he divided each degree into eight parts, making the body temperature 96 degrees (which has since been found not to be quite correct). Extending the scale upward at the same ratio, the boiling point of water was found to be 212°. Réaumur took the freezing point of water as his zero point and made each degree one one-thousandth of the volume occupied by a liquid up to the zero point. The boiling point of water was then found to be 80°. Placing the boiling point at 80° was purely accidental and was due to the particular grade of alcohol he used.

The Celsius or centigrade scale, on the other hand, is thoroughly scientific, with the freezing point of water taken as zero and the boiling point at 100°. Its use should be universal. But this is much less important than other measurements, since there would be no confusion or complicated calculations provided we had only one scale, and it would make little difference which one was used.

There is also confusion in the oil trade in the weights and measures used. Gallons are not confusing in themselves if we would only stick to the gallon, but sometimes we have to convert gallons to cubic feet or pounds. Then again, we may have business relations with

Great Britain or Canada, and to the English and Canadians a gallon means something quite different from what it means to us.

Fortunately we have the same kind of avoirdupois pound as Great Britain, but in common with Great Britain, we have, beside the avoirdupois pound, also the troy pound, and the troy pound, instead of having sixteen ounces, has only twelve, and these troy ounces in turn are different from the avoirdupois ounces.

We even have two kinds of ton, the short ton of 2000 pounds and the long ton of 2240 pounds. To add to the confusion, both of these are in use in the oil industry, for cottonseed products for domestic consumption are sold by the short ton, but for export trade the long ton is used.

One of the untoward circumstances met in the oil industry has to do with oil coming from England or her colonies. In the United States, except for export, we have only the short ton and we have a hundredweight which, sensibly enough, is 100 pounds. The British, however, have a hundredweight of 112 pounds. Instead of marking a cask of oil with the number of pounds it contains, they divide this weight by 112 and show the number of hundredweight. Not content with this, any amount above an even hundredweight is divided into quarters and finally into pounds, so that a cask containing 1210 pounds would be marked as containing 10 hundredweight, 3 quarters, and 6 pounds. It would seem that this is a lot of unnecessary trouble or would be if the destination of the oil were known to be America, for the American purchaser simply has to unscramble the mess again and express the result in pounds. We presume, however, that if the oil goes to an English purchaser, he takes it as it is and is satisfied to have the purchase expressed in hundredweights that are 12 pounds more than 100 pounds. But we have little cause to rally the Britisher for his shortcomings when we, who pride ourselves on our practicability, have made so few improvements.

It does seem that with all the confusion in our weight and measure we have been able to blunder along somehow for quite a long time, about 140 years, in fact, as a nation, and, in face of the fact that we have known better all this time and in spite of the fact that the change was urged at the very beginning of our country's career and was championed by some of the most prominent men of the time, among them Washington and Jefferson, we are apparently no further advanced in this respect today than we were then.

What will be the outcome? Will we blunder along for another century or more in the same haphazard way? This does not seem probable, for there are already hopeful signs. The advocates of the metric system are pushing along slowly but surely. Already some of the scientific societies refuse to accept for publication in their journals papers in which weights and measures are expressed in any other than metric terms.

There is more agitation for sensible standards than ever before. There is now a society, called the Metric Association, organized for the purpose of bringing about the use of metric weights and measures.

We believe the agitation is too strong in its forward movement and is gaining too many adherents ever to go back. It may take a long time yet and considerable education

There is no question as to the desirability of the change. That is agreed by practically all who have given it any thought. Perhaps the greatest barrier is conservatism, or is it simply inertia? It is always difficult to throw off old habits and form new ones, and it is difficult to set the machinery in motion to make the change. The question also presents itself as to the expediency of scrapping present standards and the cost of doing this. There is also the question of adequate organization to bring about the desired end. As to the scrapping of present standards, there is no doubt that the cost in the aggregate would be considerable. That it would be more than offset by the saving in time and convenience to ourselves and generations to come may be regarded as certain. There are some industries where there would be a certain amount of confusion for a time and perhaps considerable expense. Probably the automobile industry would feel its effects as much as any other, and yet Elwood Haynes, whose name was one of the earliest connected with the automobile industry, was, until his recent death, one of the staunchest advocates of the metric system.

America has been highly endowed by nature with vast resources and wealth, but we need every advantage in our competition with the world, and should make every possible effort to remove the handicap of old methods of measurement which have long been abandoned by most of the countries of the world as obsolete.

E. L. Patch Expands

The E. L. Patch Company, Boston, Mass., have installed many new plants along the Atlantic coast during the past year. The increasing sales for the company's cod liver oil has made necessary a larger supply of livers, which it is the function of these plants to supply. The company also has developed a new type of cooker which is being successfully operated on the large steam trawlers while they are far out at sea.

As soon as the nets are hauled in, the fish are immediately cleaned. The fresh livers are taken by our men who ship with the crew, directly to the cooker where the oil is extracted at once.

The crude oil thus produced right at the source of the fresh liver supply is taken to the main plant at Gloucester, Mass., where it is chilled to remove the stearin. Officials of the company say that it is only by giving this close attention to the matter of fresh liver supply can they maintain the high quality of their Cod Liver Oil.

BUYS THE COTTON OIL PRESS

Louis N. Geldert, Editor of the Cotton Oil Press, has purchased that publication from the Interstate Cotton Seed Crushers Association. Commiting on the change of ownership, a contemporary says:

"As long as the publication was owned and issued by the association, it was, strictly speaking, a house organ. Of late, there has been a growing tendency to discount the editorial importance of legitimate educational propaganda appearing in association owned bulletins. The products of the cotton seed crushers are such, and their sale so combated by foolish legal measures, as to necessitate a deal of educational propaganda, and it is of utmost importance that no stone be left unturned in the effort to make the association's research work appear entirely free of prejudice."

Soft Pork: A Serious Economic Problem

By N. R. ELLIS

United States Department of Agriculture

THE occurrence of a soft or oily condition in chilled hog carcasses and in the retail pork products has formed a serious economic problem in this country for many years. Price discriminations against soft and oily carcasses have resulted because of difficulties attached to the marketing and use of the products, particularly the lard, bacon and certain fresh products. The producer has faced a complex problem in his attempts to realize the greatest profit from the sale of his product.

For many years the soft pork problem was largely confined to the peanut-growing sections of the South. However, the scope of the problem has materially enlarged in recent years. The inroads of the boll-weevil in the cotton-growing sections led to an expansion in the growing of peanuts and their use as a hog feed. The recognition of the soy bean as a soil improvement crop and as a valuable livestock feed has been followed by a rapid extension of its cultivation throughout the greater portion of the country. The soy bean has come to be recognized as a valuable protein feed which can be grown and used in conjunction with corn for hog feeding. In addition, other feeds which are more or less sectional as to their growth and utilization are known to produce soft pork and are being given serious attention in studies of the problem now under way.

Feed is generally recognized as the principal cause of soft pork. In most cases the feeds responsible for producing softness are so well adapted for use in the region where they are grown and fed that their elimination as a hog feed has not appeared to be practicable. Accordingly, methods have been sought to overcome the softness developed during a period when softening feeds have been fed; usually by subsequent feeding of hardening rations. In other words, the purpose has been to utilize the softening feeds at hand along with a sufficient quantity of hardening feeds to the best advantage in order to secure hogs of marketable hardness. Studies have been made of other factors which influence the process of fat formation or the character of fat formed, such as weight of the animal at the start of the feeding period, the total gain, and the rate of gain on different rations at various stages in the growth of the animal.

The firmness of the fat in the adipose tissue of the hog is almost entirely responsible for the firmness of the chilled carcass and the pork products. From the production standpoint, the problem as already indicated resolves itself largely into a study of fat metabolism. It is particularly one of anabolism since the hog builds up a very large store of fat when fed to the usual market weight of 200-225 pounds. The quantity and quality of the fats in the various hog feeds influence the firmness of the body fat. The fat derived from feed fat is not materially changed during the process of absorption and deposition. Most of the com-

mon hog feeds in this country not only contain a considerable quantity of fat but this fat is usually oily, i.e., composed of a large amount of unsaturated fatty acids.

The body fat not derived from ingested fat is synthesized from carbohydrate and occasionally from protein. Such fat is normally firm. The firm pork products of Europe are to be ascribed largely to the use of such feeds as barley, potatoes and skim milk which are all low in fat. The availability of such pork products has led the European bacon industry to discriminate against the softer products from the corn-feed hogs of this country. The firmness of the body fat, providing other factors are equal, will be greater when a large proportion of the deposited fat is derived from carbohydrate and protein and only a small proportion comes from the oils in the feeds. It is the relation between the fat synthesized by the animal and that derived from the feed which largely determines the relative firmness of the adipose tissue.

The hogs used in the present investigations are fed at the experiment stations in co-operatively arranged experiments. They are shipped to the U. S. Animal Husbandry Experiment Farm at Beltsville, Maryland, for slaughter, carcass grading of firmness, and laboratory study of the fats. The carcasses are graded by an official committee appointed by the co-operating agencies. The grades of firmness which are recognized are hard, medium hard, medium soft, soft and oily. Hogs grading hard or medium hard are regarded as acceptably firm on the market while those grading medium soft, soft or oily are unsatisfactory and subject to price discrimination.

Laboratory work on the soft-pork problem has two objects, first to measure the firmness of the carcasses in the terms of fat constants. In this work the refractive index of the back fat has been found to be a correlative measure of firmness. The second phase of the activities of the laboratory relates to work on fat metabolism involving quantitative studies on fat formation and on the fatty acid composition of the fat to throw additional light on various aspects of the problem.

The work is still in progress so the results on only a limited number of rations which have been studied the most extensively can be discussed.

The differences in the firmness of young immature pigs and fully developed, mature hogs when fed on ordinary rations with a moderately low fat content was observed early in the investigations. On a ration of corn with non-softening supplements, such as tankage or skim milk, the carcasses of young animals were soft but with increase in age and weight the carcasses became progressively harder. It was not until the hog of medium type weighed approximately 175 pounds that a strictly hard carcass was produced. Study has been made of the relation of the feed constituents, particularly the fat to the composition of the animal body and the composition of the body fat at a number of stages of growth for several litters of pigs. It was found that the progressive hardening was accompanied by a rapid increase in the rate of fat deposition, and this in turn caused a widening in the ratio of body fat derived from carbohydrate and protein (hard) to that derived from ingested fat (soft). In other words, the amount of fat deposited in a weanling pig for each pound of

gain of live weight was not far in excess of the amount of ingested oils. The body fat deposited at this stage was soft since only a small additional amount of synthesized fat was laid down in the tissues. In a well-grown 225-pound animal, the amount of fat deposited may be three times the amount ingested on the corn ration. The body fat deposited under such conditions is accordingly much firmer due to the large quantity of synthesized hard fat which is formed. The progressive development of firmness of the fat brought about in such a manner is shown in the change in fat composition. Such fat constants as the iodine number, refractive index and melting point have shown increase in firmness. Analysis of the fatty acids showed that the amount of linolic acid in the entire body of the animal at any given stage of growth was always less than the total amount consumed in the feed. The oleic acid and the total saturated acids were synthesized in increasingly large amounts and the quantities present were in excess at all times of those ingested. There was a steady decline in the percentage of linolic acid in the body fat accompanied by an increase in the percentage of total saturated acids.

Rations of rice polish or rice bran with protein supplements, ground soy-beans 1 part mixed with corn meal 3 parts, soy-beans with a medium ration of shelled corn, soy-beans alone, and peanuts alone have produced unsatisfactory carcasses which ranged in general in the order listed from medium soft to oily. The first 3 named rations produced largely medium soft and soft carcasses while the last 3 produced largely soft and oily carcasses. For initial weights ranging from approximately 50 to 150 pounds, the softness or oiliness is developed more quickly at the lower weights. When moderately softening rations, such as those containing rice polish and rice bran, were fed to pigs weighing 100 pounds or less, there was a period of rapid softening which was usually followed by a period of gradual hardening as the hog reached the stage of high fat storage. Rations of peanuts and soy-beans produced distinctly oily carcasses. On both rations there was a steady increase in the degree of softness with increase in gain which was apparently limited in the case of the peanut ration by the degree of unsaturation of the feed fat. Although soy-beans do not contain as high a percentage of oil as peanuts, the oil is more highly unsaturated. Soy-bean feeding has produced lards of higher iodine number than from peanut feeding. However, no cases have been found in which "soy-bean" lards have been as comparable in composition to soy-bean oil as the "peanut" lards have been to the peanut oil. In the majority of cases peanuts have produced greater oiliness of the carcass. It would appear that the peanut ration is such that synthesis is reduced to a minimum and that the fat deposited is largely the peanut oil ingested. This condition is probably due to the high oil content of the peanut ration.

The question as to the exact nature of the fat formed on a fat-free ration has been answered in large measure by results from the feeding of brewers' rice as the basal feed. This by-product of the rice milling industry usually contains less than 1 per cent of fat. The lard from hogs fed brewers' rice and protein supplement from weaning or shortly after until they reach a market weight of 200 pounds and over was extremely firm. The

iodine number and refractive index were both low while the linolic acid content in some cases fell below 2 per cent.

The results of a rather complete separation of the fatty acids on lards from hogs fed such basal feeds as brewers' rice, corn, soy-beans and peanuts is contained in the table. The predominating fatty acids were oleic, linolic, palmitic and stearic. The last two named occurred in a ratio of approximately 2:1. The linolic acid was particularly influenced by the amount present in the feed. The glyceride varied from 1.2 per cent in Sample 1 (brewers' rice) to 38.3 per cent in Sample 6 (soy-beans). Small amounts of linolenic acid occurred in Samples 5 and 6, but these amounts were much smaller than found in soy-bean oil. Likewise the arachidic acid in Samples 3 and 4 was much below that found in peanut oil. The largest amount of myristic acid was found in the lard from the hogs fed brewers' rice, i.e., where the largest proportion of the body fat had been synthesized. Peanut, soy-bean and corn oils are reported not to contain this acid.

The results thus far reported on the hardening of soft hogs have been principally on hogs of initial weights of 85 pounds and over which have been fed corn subsequent to the softening period. Brewers' rice has been used in place of corn in a few experiments conducted at stations adjacent to the rice-growing sections. When corn was fed subsequent to such softening feeds as peanuts, soy-beans, rice polish and rice bran, an increase in firmness resulted. The rate of hardening was usually much slower than the rate of softening. With increase in gain on softening feed, a corresponding increase in gain on hardening feed was required to produce a certain degree of firmness providing rates of gain within the periods were comparable. When the hardening period was extended,

Average Composition of the Fat of Hogs on Feeds Varying in Quantity and Quality of Oil

	Sample number and basic feed					
	1 Brewers' Rice	2 Corn	3 Peanuts	4 Peanuts	5 Soy-beans	6 Soy-beans
No. of hogs in lot.....	11	6	3	3	9	1
Total gain on experiment lbs.	178	201	58	149	65	98
Slaughter weight—lbs.....	242	231	151	201	152	175
Carcass grade	Hard	Hard	Oily	Oily	Oily	Oily
Fat composition:						
Iodine number	52.6	58.8	84.1	91.8	90.7	100.6
Refractive index—40°C	1.4582	1.4587	1.4619	1.4633	1.4628	1.4636
Melting point °C.....	39.7	37.5	22.5	liquid at 5°	22.0	28.1
Glycerides in fat:						
Oleic, per cent.....	58.4	54.3	56.7	64.6	40.4	39.8
Linolic, per cent.....	1.2	7.1	19.5	19.7	31.9	38.3
Linolenic, per cent.....	0.0	0.0	0.0	0.0	0.02	0.5
Arachidonic, per cent...	0.2	0.06	0.12	0.05	0.08	0.05
Myristic, per cent.....	1.8	0.7	0.4	0.1	0.8	0.3
Palmitic, per cent.....	26.5	25.2	15.5	10.4	17.4	14.5
Stearic, per cent.....	12.2	12.8	7.5	4.9	9.4	8.0
Arachidic, per cent.....	0.0	0.0	0.2	0.3	0.0	0.0

there was an increase in firmness in proportion to the ratio of gains. The results have shown that a gain ratio of 1:3 on peanut-corn and 1:2 on soy-beans-corn still produced medium soft carcasses while wider ratios permitted the production of medium-hard carcasses.

In the case of soy-beans with a medium ration of corn, and rice polish or rice bran with protein supplements a gain in weight on corn with non-softening supplements equal to that on the softening feeds did not produce firm carcasses. Although the softness developed on the rations just named was not so great as on peanuts or soy-beans alone, it required considerably more gain on hardening feed than on softening feed to produce medium hard carcasses. Here, as in the case of peanuts and soy-beans alone, it was impossible under practical conditions, with feeding perods of 6 to 8 weeks duration, to secure firm carcasses at the usual market weights of 200 to 225 pounds. It was, however, possible to accomplish this purpose when brewers' rice was used in place of corn following rice polish or rice bran.

Study of the composition of the fats from hogs fed the various feed combinations just mentioned showed that there was a pronounced decrease in the unsaturation as the gain in weight on hardening feed increased. As would be expected, the fat constants and the percentages of the fatty acids seldom reached the level found in lards from hogs fed hardening rations throughout their growth. It is apparent that the hard fat formed on feeds like corn or brewers' rice is deposited in the same tissues as was the soft or oily fat during the softening period. The addition of more hard fat develops greater firmness of the adipose tissue. During the hardening period, the rate of fat formation is high which is especially favorable for the development of hard fat on a corn ration. However, the quantity of oily fat already present is too great to be readily offset by the addition of a hard fat in itself little different than that demanded in a firm carcass. Were it not for the relative scarcity of brewers' rice, this feed could be more widely used for it is evident that a highly carbonaceous feed with a low oil content is quite essential in a highly effective hardening feed. Other feeds of like properties may be found which will help the situation.

Note: A co-operative investigation of this problem has been in progress since 1919. The agencies engaged in the work are the Bureau of Animal Industry of the United States Department of Agriculture, a number of State and Federal experiment stations and the Institute of American Meat Packers. The State experiment stations which have taken part in the work are as follows: Alabama, Arkansas, California, Georgia, Indiana, Kentucky, Mississippi, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas and Virginia. This article is based on results of the co-operative investigations published to date as follows:

(1) U. S. D. A. Dept. Bull. 1407. Results of soft pork investigations.

(2) Bulletin in course of publication. Further results of soft pork investigations.

(3) Soft Pork Studies. I. Formation of fat in the pig on a ration moderately low in fat. Ellis, N. R. and Hankins, O. G. Jr. Biol. Chem., *66* (1925), 101.

(4) Soft Pork Studies. II. The influence of the character of the ration upon the composition of the body fat of hogs. Ellis, N. R. and Isbell, H. S. Jr. Biol. Chem., *69* (1926), 219.

(5) Soft Pork Studies. III. The effect of food upon body fat as shown by the separation of the individual fatty acids of the body fat. Ellis, N. R. and Isbell, H. S. Jr. Biol, Chem. *69* (1926), 239.

Uncle Sam Makes a Census of Soap

THE Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1926, the establishments engaged primarily in the manufacture of soap (hard, soft, powdered, liquid, etc.), including the soap departments of large slaughtering and meat-packing establishments, reported, for 1925, a total output valued at $270,273,107, of which amount $229,948,291 was contributed by soap and $40,324,816 by other products, such as glycerin, perfumery, toilet preparations, etc. The production of soap shows an increase of 2.3 per cent in value as compared with $224,690,560 for 1923, the last preceding census year.

The items which make up the total of $229,948,291 for soap made in 1925 are as follows: Hard soaps, 2,018,568,000 pounds, valued at $182,714,092; granulated and powdered soap, 142,322,000 pounds, valued at $15,789,485; soap powder, 398,947,000 pounds, valued at $19,400,311; special soap articles valued at $6,709,567; liquid, paste, and soft soaps, and soap stock or soap base, valued at $5,334,836.

Of the 266 establishments reporting for 1925, 33 were located in Pennsylvania, 32 in New York, 30 in California, 28 in Illinois, 25 in Ohio, 24 in Massachusetts, 15 in New Jersey, 10 in Wisconsin, 9 in Rhode Island, and the remaining 60 in 19 other States. In 1923 the industry was represented by 270 establishments, the decrease to 266 in 1925 being the net result of a loss of 50 and a gain of 46. Of the 50 establishments lost to the industry, 39 had gone out of business prior to the beginning of 1925, 6 were idle during the entire year, and 5 reported commodities other than soap as their principal products and were therefore transferred to the appropriate industries.

Summary statistics for the industry are given in Table 1 below; and statistics of products by class, quantity, and value are presented in Table 2 on the page following.

TABLE 1. SUMMARY FOR THE INDUSTRY, 1925 AND 1923

	1925	1923	% increase or decrease (—)
Number of establishments	266	270	—1.5
Wage earners (average number)[1]	14,926	17,002	—12.2
Maximum, month	Nov. 15,359	Mar. 17,691	——
Minimum, month	July 14,552	July 16,230	——
Per cent of maximum	94.7	91.7	——
Wages[2]	$18,026,854	$20,776,443	—13.2
Cost of materials (including fuel, electric power and containers)[2]	180,373,537	173,545,981	3.9
Products, total value[2]	270,273,107	276,402,838	—2.2
Soap	229,948,291	224,690,560	2.3
Other products	40,324,816	[3] 51,712,278	—22.0
Value added by manufacture[4]	89,899,570	102,856,857	—12.6
Horsepower	54,677	74,820	—26.9

[1]Not including salaried employees.
[2]The amount of manufacturers' profits can not be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest, rent, depreciation, taxes, insurance and advertising.
[3]The value of "Other products" shows for 1923 is not strictly comparable with that for 1925 because of changes in the classification of certain establishments.
[4]Value of products less cost of materials.

TABLE II. PRODUCTS BY CLASS, QUANTITY AND VALUE, 1925 AND 1923

		1925	1923
Total value		(1)	$281,294,774
The soap industry, all products,	val.	$270,273,107	$276,402,838
Other industries, subsidiary soap products	val.	(1)	$4,891,936
Soaps	val.	$229,948,291	$229,582,496
Hard soaps	lbs.	2,018,568,000	2,000,340,000
Hard soaps	val.	$182,714,092	$179,924,316
Toilet soaps	lbs.	257,554,000	240,144,000
Toilet soaps	val.	$46,643,664	$53,098,527
Laundry soap, white	lbs.	755,550,000	.....
Laundry soap, white	val.	$49,981,459	.....
Laundry soap, yellow	lbs.	613,395,000	1,082,626,000
Laundry soap, yellow	val.	$42,755,099	$66,425,243
Foots soap	lbs.	11,903,000	.....
Foots soap	val.	$1,044,104	.....
Soap chips, in packages	lbs.	183,386,000	.....
Soap chips, in packages	val.	$24,219,085	218,754,000
Soap chips, in barrels	lbs.	139,366,000	$25,373,176
Soap chips, in barrels	val.	$11,837,060	.....
Other hard soaps	lbs.	57,414,000	458,816,000
Other hard soaps	val.	$6,233,621	$35,027,370
Granulated and powdered soap—			
In packages	lbs.	89,224,000	.....
In packages	val.	$10,681,483	.....
In barrels or bulk	lbs.	53,098,000	655,061,000
In barrels or bulk	val.	$5,108,002	$39,799,073
Soap powder, including cleansing, scouring and washing powders	lbs.	398,947,000	.....
Soal powder, including cleansing, scouring and washing powders	val.	$19,400,311	.....
Special soap articles	val.	$6,709,567	$1,600,242
Liquid soap	lbs.	10,707,000	17,879,000
Liquid soap	val.	$1,039,325	$1,666,495
Paste soap	lbs.	26,755,000	40,584,000
Paste soap	val.	$1,942,685	$3,670,198
Soft soap	lbs.	52,397,000	67,752,000
Soft soap	val.	$2,077,080	$2,465,114
Soap stock or soap base, for sale as such,	lbs.	5,382,000	7,554,000
Soap stock or soap base, for sale as such,	val.	$275,746	$457,058
Other products [2]	val.	$40,324,816	[3] $51,712,278
Glycerin, crude (for sale)	lbs.	25,842,000	23,459,000
Glycerin, crude (for sale)	val.	$3,518,471	$2,694,894
Glycerin, refined (for sale)	lbs.	72,597,000	54,418,000
Glycerin, refined (for sale)	val.	$13,091,685	$8,553,765
Stearin	lbs.	7,801,000	4,340,000
Stearin	val.	$934,645	$525,489
Candle pitch, tar or stearin pitch	lbs.	7.813,000	5.802.000
Candle pitch, tar or stearin pitch	val.	$226,734	$142,863
Red oil (commercial oleic acid)	lbs.	2,180,000	1,390,728
Red Oil (commercial oleic acid)	val.	$1,535,037	$744,770
All other products	val.	$21,018,244	$39,050,497

[1] Data not yet available.
[2] Production in the soap industry only.
[3] See note [3] ante.

Lard Substitutes and Cooking Fats for the Year 1925

THE Department of Commerce announces that, according to data collected at the biennial census of manufactures, the total production of lard substitutes and cooking fats in the United States in 1925 amounted to 1,128,993,000 pounds, valued at $147,513,000, of which 622,795,000 pounds, valued at $81,051,000, was made by establishments engaged primarily in the manufacture of these products; 450,922,000 pounds, valued at $59,561,000, by slaughtering and meatpacking establishments; and 55,276,000 pounds, valued at $6,901,000, by establishments engaged primarily in other industries. Of the 622,795,000 pounds made in the industry proper, 390,503,000 pounds, valued at $50,684,000, was reported by establishments which specified vegetable fats and oils as their principal materials, and 232,292,000 pounds, valued at $30,367,000, by establishments which specified both animal and vegetable fats and oils as their materials.

Of the 26 establishments in the lard-substitutes and cooking-fats industry proper, 5 were located in Georgia, 5 in Texas, 4 in Tennessee, and the remaining 12 in 11 other States. In 1923 the industry was represented by 27 establishments, the decrease to 26 in 1925 being the net result of a loss of 6 and a gain of 5. Of the 6 establishments lost to the industry, 2 had gone out of business prior to the beginning of 1925, 3 reported commodities other than lard substitutes or cooking fats as their principal products and were therefore transferred to the appropriate industries, and 1 reported products valued at less than $5,000. (No data are tabulated at the biennial censuses for establishments with products under $5,000 in value.)

Summary statistics for the industry proper are given in the table below.

SUMMARY FOR THE INDUSTRY: 1925 AND 1923

	1925	1923	Per cent of increase
Number of establishments	26	27	[a]
Wage earners (average number)[b]	1,962	1,684	16.3
Maximum month	Nov. 2,206	Nov. 2,023	....
Mimimum month	Apr. 1,767	May 1,388	....
Per cent of maximum	80.1	68.6	....
Wages	$1,839,000	$1,406,000	30.8
Cost of materials (including fuel, electric power, and containers)	98,660,000	52,396,000	88.3
Products, total value	110,002,000	58,787,000	87.1
Lard substitutes and cooking fats	81,051,000	[c]	....
Other[d]	28,951,000	[c]	....
Value added by manufacture[e]	11,342,000	6,391,000	77.5
Horsepower	25,174	20,769	21.2

[a] Per cent not computed where base is less than 100.
[b] Not including salaried employees.
[c] No comparable data.
[d] Chiefly refined oils, soap stock, and distilled fats.
[e] Value of products less cost of materials.

Oil and Fat Export Tonnage Is on the Increase Although Values Decline

EXPORTS of animal oils and fats from the United States for the month of October amounted to over 60 million pounds. These had a total value of nearly 9 million dollars. Exports of these products have increased slightly from what they were a year ago, although measured in dollars and cents they show a slight falling off as a result of the lower prices which they are commanding in foreign markets. For the first 10 months of 1925, exports of animal oil and fats totalled 720 million pounds as compared with 725 million this year. A year ago these products commanded an export price of 119 million dollars as against 110 million this year.

Statistics covering in detail the domestic export of oils and fats were reported by the Department of Commerce on Nov. 27 as follows:

DOMESTIC EXPORTS OF MEATS AND FATS

	Month of October		Ten months ended October	
	1925	1926	1925	1926
Total animal oils and fats .....lbs.	55,520,029	60,237,788	719,287,456	725,497,861
Total animal oils and fats	$9,599,812	$8,820,115	$118,871,201	$110,537,383
Oleo oil .....lbs.	5,085,327	8,235,757	78,579,741	82,315,662
Oleo oil	$736,769	$947,072	$10,092,968	$10,203,984
Lard .....lbs.	44,745,190	46,987,667	580,009,603	592,792,418
Lard	$8,003,503	$7,224,190	$100,357,264	$93,604,630
Neutral lard .....lbs.	1,824,203	1,559,462	16,085,943	14,995,220
Neutral lard	$370,316	$257,117	$3,055,261	$2,512,220
Lard compounds, animal fats .....lbs.	1,494,012	1,066,068	10,824,777	8,080,650
Lard compounds, animal fats	$213,533	$147,871	$1,583,830	$1,172,400
Margarine, animal fats lbs.	47,970	96,839	668,882	1,276,513
Margarine, animal fats..	$9,182	$14,262	$114,173	$175,505
Cottonseed oil .....lbs.	7,663,376	2,569,386	44,054,719	28,999,530
Cottonseed oil	$762,183	$254,585	$4,766,832	$3,038,575
Lard compounds, vegetable fats .....lbs.	1,154,716	713,347	6,577,001	5,902,277
Lard compounds, vegetable fats	$167,318	$95,115	$993,991	$886,791

Imports of Olives, Coconut Meat and Coconut Oil, Peanuts and Peanut Oil, and Edible Olive Oil Into the United States During September

Countries	Olives in brine		Coconut meat, desiccated, shredded, cut, or similarly prepared	
	Gallons	Dollars	Pounds	Dollars
France	30	76	.....	.....
Greece	10,447	6,095	.....	.....
Italy	7,979	1,711	.....	.....
Netherlands	5,020	3,366	.....	.....
Spain	315,091	269,402	.....	.....
Canada	1	1	.....	.....
Panama	.....	.....	.....	.....
Jamaica	.....	.....	.....	.....
Virgin Islands of U. S.	12	11	.....	.....
Ecuador	.....	.....	.....	.....
Peru	1,482	1,339	.....	.....
Br. Malaya	.....	.....	.....	.....
Ceylon	.....	.....	2,145,592	180,379
Java & Mad.	.....	.....	.....	.....
Other D. E. In.	.....	.....	.....	.....
Hongkong	84	59	.....	.....
Philippine Is.	.....	.....	3,035,500	244,912
Syria	36	12	.....	.....
Br. Oceania	.....	.....	.....	.....
Fr. Oceania	.....	.....	.....	.....
Total	340,182	282,072	5,181,092	425,291

PEANUTS

Countries	Shelled		Not Shelled		Peanut Oil	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Germany	22,856	1,956	.....	....	.....	.....
Italy	.....	....	32,340	3,788	.....	.....
Netherlands	.....	....	.....	....	13,682	1,615
Spain	.....	....	10,090	1,020	.....	.....
Canada	8,610	2,132	.....	....	.....	.....
China	1,088,438	46,690	145,674	5,994	1,449,744	143,382
Hongkong	600	102	1,930	245	119,805	14,254
Japan, Inc. Chosen	200	12	26,500	1,384	2,160	267
Total	1,120,704	50,892	216,534	12,431	1,585,391	159,518

OLIVE OIL, EDIBLE

Countries	In packages weighing less than 40 pounds		Other	
	Pounds	Dollars	Pounds	Dollars
Belgium	20,995	3,581	207,590	36,845
France	79,128	13,289	.....	.....
Greece	.....	.....	168,250	25,229
Italy	4,064,819	642,215	827,950	149,471
Portugal	3,196	620	.....	.....
Spain	149,477	29,780	956,525	161,463
Tur. in Eur.	.....	.....	1,120	255
United King.	230	73	.....	.....
Canada	2,052	372	2,041	370
Cuba	15,552	4,136	.....	.....
Syria	.....	.....	1,316	153
Alg. & Tun.	.....	.....	15,571	2,543
Total	4,335,449	694,066	2,180,363	376,329

Imports of Olives, Coconut Meat and Coconut Oil, Peanuts and Peanut Oil, and Edible Olive Oil, Into the United States During September

Countries	Copra		Coconut oil	
	Pounds	Dollars	Pounds	Dollars
France	.....	.....	.....	.....
Greece	.....	.....	.....	.....
Italy	.....	.....	.....	.....
Netherlands	.....	.....	.....	.....
Spain	.....	.....	.....	.....
Canada	37,778	2,164	.....	.....
Panama	3,016	159	.....	.....
Jamaica	613,800	30,777	.....	.....
Vir. Is. of U. S.	.....	.....	.....	.....
Ecuador	7,685	416	.....	.....
Peru	.....	.....	.....	.....
Br. Malaya	4,480,000	228,156	.....	.....
Ceylon	.....	.....	.....	.....
Java & Mad.	3,360,000	183,000	.....	.....
Other D. E. In.	3,052,054	133,774	.....	.....
Hongkong	.....	.....	.....	.....
Philippine Is.	27,290,631	1,382,334	16,126,991	1,313,225
Syria	.....	.....	.....	.....
Br. Oceania	1,504,179	74,502	.....	.....
Fr. Oceania	2,227,673	105,801	.....	.....
Total	42,576,816	2,141,083	16,126,991	1,313,225

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Lime Seed Oil and Oil Cake

From *The Analyst*, October, 1926

IN view of the fact that Messrs. Marshall and Salamon have been unable to discover any published data on lime seed oil (*cf.* ANALYST, 1926, 237), it has occurred to me that some account of the work done in this laboratory on lime seed* oil may be of general interest.

In 1922 a sample of oil expressed from the seeds was sent to the Imperial Institute, and their report was published in the *Imp. Inst. Bull.* (1922, 20, 465). It has been found here that there is no difficulty in obtaining a yield of about 70 per cent. of the oil present in the seeds, by expression after a preliminary heating of the crushed meal at 120° F. The ground seed, when extracted with ether, yielded 39.83 per cent. of oil, and, by expression, about 30 per cent. The expressed oil is a somewhat turbid greenish-yellow to light brown liquid, which, when filtered, gives a clear brownish yellow oil.

The values obtained with a sample of the clarified oil are shown below in Table I.

Lime seed oil extracted by pressure, like the oil extracted by a volatile solvent, has an unpleasant bitter taste, which can be removed, however, by treatment with alcohol, the resulting product being a bland tasteless oil which, like arachis oil, could be utilized as a solid oil. It belongs to the class of semi-drying oils, and is readily saponified, even at the ordinary temperature.

The manurial and feeding values of lime seeds from Dominica are shown by the following results, in which the first column gives the values for the untreated crushed seeds (freed from pulp by washing), and the second column the corresponding values for the press cake, on the assumption of a 30 per cent. expression of oil.

	Per cent	Per cent
Nitrogen	3.43	4.9
Potash	0.48	0.68
Phosphoric anhydride	0.74	1.05

Analyses of seed from Antigua and Montserrat have also given percentages of nitrogen exceeding 3 per cent.

Analytical figures indicating the value of the unextracted seeds and the press residue as cattle food are shown in Table II.

It will be seen that lime seed oil cake compares favorably as a feeding stuff with similar cotton seed products, being slightly lower in carbohydrates but richer in crude proteins.

Table I—Showing Values Obtained from Clarified Oil

Sp. gr. at 27°/15.5° C.	Solidif Pt. °C.	n_D^{28}	Acid value	Sapon value	Iodine value (Hübl)	Sol. in alcohol Per cent	Unsap matter Per cent
0.9138	—3	1.4740	11.2	193.5	109.7	0.18	0.72

Table II—Showing Cattle Food Values

	Moisture Per cent	Ash Per cent	Oil Per cent	Crude proteins Per cent	Crude fibre Per cent	Carbohydrates Per cent
I	10.54	2.22	39.87	21.37	14.10	11.90
II	15.08	3.17	14.20	30.50	20.05	17.00

Cattle eat raw and crushed lime pulp with avidity, and so do pigs. Both appear to thrive on these products, and the local milk from cattle in Dominica, which are systematically fed with them, is usually very rich, and much above the minimal limits adopted under the Food and Drugs Ordinance (*viz.* Fat, 3.0; solids-not-fat, 8.5 p.c.).

An admixture with molasses should overcome any repugnance of cattle to the slightly bitter taste of the seed meal. In feeding experiments, made for this department on a small scale, it was found that horses, mules and cattle either readily consumed the mixture or could easily be educated to do so. Pigs, however, contrary to expectation, appeared indifferent to, or were repelled by the material.

The importance of disposing profitably of this waste product of the citrus industry is obvious from the fact that in the island of Dominica alone the average lime crop is about 400,000 barrels, each barrel containing the equivalent of 32 lbs. of wet, or 3 lbs. of dry seeds. In other words, about 535 tons of dry lime seeds are produced annually as a waste product in that presidency alone.

A. E. COLLENS
Government Laboratory for the Leeward Islands, Antigua.

*The pips are termed seeds in the British West Indies.

Keeping Quality of Peanut Oil

(*Continued from page* 431)

fore if the crude peanut oil is to be stored at the oil mill while waiting for favorable market conditions or for shipment to the refinery the foots should be removed. This the authors also have shown to be the case with cottonseed oil.*

* J. Oil and Fat Ind., 3, 75 (1926).

ABSTRACTS

Inhibiting Agents in the Oxidation of Unsaturated Organic Compounds. O. M. Smith and R. E. Wood (Ind. Eng. Chem., 1926, 18, 691-694).—By measurement of the volume of oxygen absorbed the authors have examined the effect of numerous substances on the atmospheric oxidation of oils and fats, fatty acids, soaps, and rubber. Active inhibitants may be divided into two main groups, powerful reducing agents such as stannous compounds, sodium thiosulphate, etc., and strong bases, particularly amines. The action of sodium hydroxide, carbonate, silicate, and phosphate is possibly due to their combination with substances produced by oxidation which themselves act as catalysts. Aromatic alcohols and phenols are also effective as inhibitants. The inhibiting substance will prevent oxidation at any period during the oxidation and in general stability and resistance towards oxidation increases with the concentration of the inhibitant. In some cases, e. g., phenols, such as eugenol, there is a concentration at which the inhibitant is most effective and above which it acts as a positive oxygen catalyst. The influence of the inhibitant is only temporary, the period depending on the temperature, concentration, and products of oxidation. After the effect of the antioxidant is lost the rate of oxidation is the same as before. It is suggested that the basic inhibitors combine with acidic oxidation products and prevent them acting as autocatalysts in the oxidation, or that the partial valencies of the tervalen nitrogen atom (or other elements with free valencies) form intermediate compounds with the easily oxidized ethylenic carbon atoms. This temporary compound controls the rate of oxidation for a definite but limited time.—R. Brightman.

The Phytosterols of Rice Bran Fat, Fred P. Nabenhauer and R. J. Anderson. *The Phytosterols of Corn Oil,* R. J. Anderson and R. L. Shriver. *The Phytosterols of Wheat Germ Oil,* R. J. Anderson, R. L. Shriver and G. O. Burr.

The above three articles in the *Journal of the American Chemical Society,* November, 1926, are a valuable addition to the literature of the unsaponifiable constituents of vegetable oils.

BOOK REVIEW

EDIBLE OILS AND FATS, THEIR SUBSTITUTES AND ADULTERANTS. By G. D. Elsdon, B.Sc., F.I.C., Lancashire County Analyst. Ernest Benn, Ltd., 1926. Pp. 521. 45s.

Mr. Elsdon's book is a thoroughly comprehensive treatise which will at once take its place among the standard works of reference on the analytical examination of fatty oils. The work involved in compilation of a manual of this kind at the present day is enormous, and praise is due to the author for the thoroughness with which the task has been carried out, and also for the concise manner in which, having regard to the great number of references which are necessarily cited, the data have been presented. This aspect of the book is also greatly assisted by the good indexes and abundant sectional bibliographies which are given, and by the convenient system of giving the majority of original references as abstracts either in the *Analyst* or the Journal of the Society of Chemical Industry.

The analytical methods employed in the field of oils and fats, whether technical or dealing with the chemical constitution of the components, are both numerous and involved, owing to progressive improvements, real or supposed, which have been superimposed continuously upon the original processes proposed; at the same time there exist many lacunæ in our knowledge of these materials, probably more so than in any other branch of organic chemistry at the present day.

It is, therefore, good to find that the book stands out in its class in that the author does not merely describe, non-critically, a string of analytical processes for the determination, say, of the iodine number of a fat, but adds a paragraph "Method suggested," in which the relative values of the variant processes are assessed succinctly for particular cases which may arise. Similarly, he indicates freely throughout the text those parts of the subject which are still in much need of further research, and in this respect the work is to be regarded not only as an analytical handbook, but as an aid and stimulus to the investigator.

It may be asked, perhaps, whether certain sections of the book fall strictly within the scope of "Edible Oils and Fats," such as those on glycerol, and on rosin and rosin oils; also, perhaps the customary long lists of salts of the fatty acids on pp. 20-30, 34, 35, etc., might have been shortened with advantage, and again the number of individual oils described on pp. 168-187, 196-211, 237-249, 279-300, 323-354 may be unnecessarily large, although it is admittedly difficult to know where to draw the line.

The following minor points may be referred to for attention in the second edition which undoubtedly soon will be necessary—P. 36: "Unsaturated acids $C_nH_{2n-2}O_2$" should be "$C_nH_{2n-4}O_2$"; p. 46: Twitchell's lead salt-alcohol method is sufficiently sound to warrant more extended mention: P. 54: The references to "p. 21" and "p. 140," obviously do not refer to the present book and have apparently been transcribed from Crowther and Hynd's original paper. P. 103: "Oswald" should read "Ostwald." P. 305: The reference to Matthes and Rohdich's work refers to unsaponifiable matter from "this quantity of fat," "this quantity," however, not being specified.*

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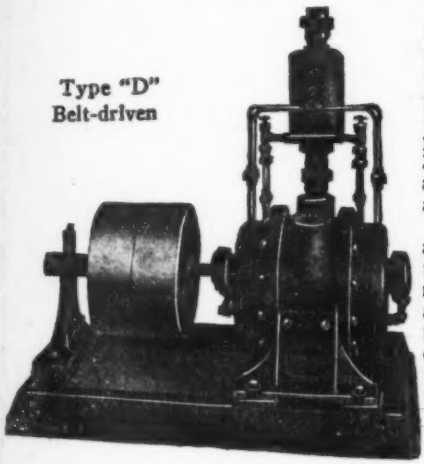

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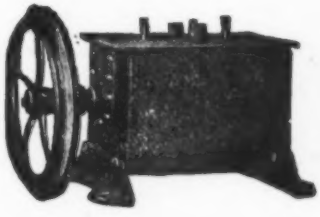

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